CLAIMS

WHAT IS CLAIMED IS:

1. A rotatable downhole assembly adapted for conveying in a borehole and determining a parameter of interest of a medium proximate to the borehole, the downhole assembly comprising:

(a) a navigation assembly including a first sensing device including at least one of (i) a gyroscope, (ii) a magnetometer, and, (iii) an accelerometer, for providing a measurement indicative of toolface angle of the downhole assembly, said navigation assembly associated with a first processor;

(b) a directional evaluation device for providing measurements indicative of the parameter of interest, said directional evaluation device associated with a second processor; and

(c) a common bus operatively connected to the first processor and the second processor.

2. The rotatable downhole assembly of claim 1 wherein the first sensing device further provides an indication of a location of the downhole assembly.

3. The rotatable downhole assembly of claim 1 wherein said directional evaluation device further comprises a formation evaluation device.

4. The rotatable downhole assembly of claim 1 wherein said navigation assembly

and said second sensing device are conveyed one of (A) a drillstring, (B) a coiled tubing, and, (C) a wireline.

5. The rotatable downhole assembly of claim 1 wherein said navigation assembly is on a first housing and said directional formation evaluation device is on a second housing, said first and second housing encircling a drive shaft with a mud motor at a first end and a drilling device at a second end.

6. The rotatable downhole assembly of claim 1 wherein said navigation assembly comprises a gyroscope selected from (A) a two-axis gyroscope and, (B) a three-axis gyroscope.

7. The rotatable downhole assembly of claim 1 wherein said navigation assembly comprises a three-component magnetometer.

8. The rotatable downhole assembly of claim 1 wherein:

(I) said first processor processes signals from said first sensing device, while the downhole assembly is being rotated, to provide a value of an instantaneous tool face angle, said value being communicated on the common bus at specified intervals, and;

(II) wherein said second processor processes signals from the directional evaluation device, while the downhole assembly is being rotated, and provides a signal indicative of the parameter of interest, said signal being

communicated on the common bus at specified intervals.

9. The rotatable downhole assembly of claim 8 further comprising one of (A) a telemetry device for transmitting information about the parameter of interest to an uphole device, and, (B) a memory for storing values of the instantaneous tool face angle and signal indicative of the parameter of interest.

10. The rotatable downhole assembly of claim 8 wherein said processing of signals from the first sensing device by the first processor is independent of said processing of signals from the directional evaluation device by the second processor.

11. The rotatable downhole assembly of claim 10 wherein said first and second processors are spaced apart.

12. The rotatable downhole assembly of claim 10 wherein said first and second processors are not spaced apart.

13. The rotatable downhole assembly of claim 3 wherein said directional formation evaluation device further comprises at least one of (I) at least one gamma ray, (II) a resistivity device, (III) a density logging device.

14. The rotatable downhole assembly of claim 13 wherein said at least one gamma

ray detector further comprises a pair of gamma ray detectors on opposite sides of the rotatable downhole assembly.

15. The rotatable downhole assembly of claim 10 further comprising a processor for synchronizing said value of the tool face angle with the signal indicative of the parameter of interest.

16. The rotatable downhole assembly of claim 15 further comprising one of (A) a telemetry device for transmitting information about the parameter of interest to an uphole device, and, (B) a memory for storing values of the instantaneous tool face angle and signal indicative of the parameter of interest.

17. The rotatable downhole assembly of claim 15 wherein said processor is one of the first processor and the second processor.

18. A method of determining a parameter of interest of a medium proximate to a borehole using a rotating downhole assembly in said borehole, the method comprising:

(a) obtaining information about a tool-face angle of the assembly during rotation thereof;

(b) using a directionally sensitive evaluation device for obtaining measurements indicative of the parameter of interest, said measurements being obtained separately over a plurality of specified time intervals; and

(c) using at least one processor for determining from said obtained information and said measurements of the directionally sensitive evaluation device, partially processed measurements indicative of the parameter of interest over a plurality of sectors of said tool face angle.

19. The method of claim 18 wherein obtaining said information about said tool face angle further comprises:

(i) using a navigation assembly including a first sensing device that is at least one of (A) a gyroscope, (B) a magnetometer, and, (C) an accelerometer, for providing a measurement indicative of said toolface angle; and

(ii) using a processor associated with the navigation assembly for determining said toolface angle over said time intervals.

20. The method of claim 19 wherein said rotating downhole assembly further comprises a drill bit for penetrating a formation, the method further comprising using at least one of (I) said gyroscope, and, (II) an accelerometer, for determining a rate of penetration (ROP) of said downhole assembly.

21. The method of claim 13 further comprising using said at least one processor for approximating said partially processed measurements by a series expansion that includes a sinusoidal variation with said tool face angle.

22. The method of claim 21 wherein said series expansion further includes a

sinusoidal variation of twice said tool face angle.

23. The method of claim 18 wherein said directional evaluation device further comprises at least one gamma ray detector.

24. The method of claim 22 wherein the at least one gamma detector further comprises a pair of gamma ray detectors on substantially opposite sides of the downhole assembly.

25. The method of claim 23 further comprising using a drill bit coupled to the downhole assembly for penetrating a formation and using measurements from said at least one gamma ray detector for determining a relative inclination of the borehole to a formation boundary.

26. The method of claim 24 further comprising using a drill bit coupled to the downhole assembly for penetrating a formation and using measurements from said pair of gamma ray detectors for determining a relative inclination of the borehole to a formation boundary.

27. The method of claim 18 wherein said directional evaluation device further comprises a resistivity device,

28. The method of claim 18 wherein said directional formation evaluation device

further comprises a density measurement device.

29. The method of claim 21 further comprising using a processor for determining from said series expansion an indication of proximity to a bed boundary in the subsurface formation.

30. A method of obtaining a processed image of a borehole in an earth formation using a rotating downhole assembly in said borehole, the method comprising:

(a) obtaining information about a tool-face angle of the assembly during rotation thereof;

(b) using a directionally sensitive evaluation device for obtaining measurements indicative of a property of said earth formation at a plurality of tool-face angles;

(c) repeating (a) and (b) at a plurality of different times and a raw data set;

(d) fitting said raw data set at each of said plurality of different times to obtain a partially processed data set;

(e) applying a low pass filter to said partially processed data set at each of said plurality of tool-face angles and defining a fully processed data set; and

(f) displaying said fully processed data set as an image..

31. The method of claim 30 wherein said fitting further comprises using a sinusoidal function.

32. The method of claim 30 further comprising determining contours of an equal value of said fully processed data set.